memory associated with a display device or the computer system to which the multi-layer display is connected. In this way, each user would consistently view multiple display elements in a preferred way. For example, a particular user could prefer certain coloured display elements on a particular display layer or that user may prefer that brighter display elements are presented in front of darker display elements, either within a single display layer or over multiple display layers. These user preferences could then be stored in a data file, updated and retrieved when required in order to usefully automatically allocate display elements to and/or within layers.

[0121] Similarly, preference data files relating to certain software applications run on the computer system and viewed via the multi-layer display device could be stored. In this way, the control system could consistently display software applications to all users. For example, MICROSOFT® WORD could have a preference file instructing the control system to, for example, always display pop-up windows or dialogue boxes on the top layer of the multi-layer display device. The preference data file for each software application could be user created/modified or manufacturer created/modified.

[0122] Each display element in a graphical user interface in a multi-layer display is conventionally associated with parameters of its "x,y position", "layer" (and/or "screen" in multi-screen systems) and "order". The "order" parameter dictates which display element should be displayed in front of or behind any other display element when overlap of different display elements occurs. Overlap in the context of this specification means that, from a viewer's perspective, at least a portion of a first display element is obscured or blocked or occluded by a portion of a second display element (or by two or more other display elements). However, because multi-layer display devices have conventionally been treated as multiple stacked but separate devices, it has been possible for a display element on a back layer which is active (that is, the display element which the user is currently interacting with which is sometimes referred to as "in focus" or "in context") to unintentionally be obscured by a non-active display element on a front layer.

[0123] The present invention treats the multiple layers of an MLD holistically rather than as separate devices and, because of the stacked or sandwiched interrelationship of the display layers between the user and a backlighting system, faces the above unique problems not encountered in "mixed" display systems of multiple SLD units.

[0124] According to the present invention, the "order" parameter may be replaced by an "order within layer" parameter and a further parameter, "viewing order" may be provided. The "order within layer" parameter is equivalent to the conventional "order" parameter but will only apply within each respective layer. The new "viewing order" parameter will determine, over all display layers and over all interconnected display devices, which display element has precedence when overlap of display elements occurs. In this way, the above-mentioned problem of blocking of active windows can be avoided. As mentioned above, the present invention may be utilised in various types of multi-layer display systems including a single MLD, multiple interconnected MLD devices, or interconnected single-layer display (SLD) devices and MLD devices. Preferably however, at least one MLD is incorporated into the multi-layer display system.

[0125] As mentioned above, a problem occurs when two display elements such as GUI windows, both displaying text, are positioned over each other (that is, they overlap) in separate display layers of a multi-layer display device. The result is that the text on both layers is very difficult (if not impossible) to read. "Text-On-Text" is the name which we have given to the problem however it is not limited to situations involving text. Overlaying text on a graphic image (or vice versa) can have the same effect of rendering the text difficult to read. More specifically, the problem can be described as being at its worst:

[0126] when there is very little contrast between the overlapped display elements or images displayed on different display layers, and/or

[0127] when at least one display layer is displaying cluttered information.

[0128] A solution which we have discovered to this problem is to use "alpha blending" on a multi-layer display system to effectively effect the transparency of, on a pixel by pixel basis, the information that is not active (that is, not presently selected or "in context"), whether it is on a front or rear display layer. Transparency could, for example, be increased by increasing the amount of white in the colour of a display element.

[0129] In computer graphics, each pixel is represented by three channels of 8-bit colour information—red, green, and blue—and sometimes a fourth channel called the alpha channel. The alpha channel controls the way in which other graphics information is displayed, such as the level of transparency or opacity of the pixel. Alpha blending is the name for this type of control, and it is used to simulate effects such as the visual effect obtained by placing a piece of glass in front of an object so that the object is either completely visible behind the glass, unviewable, or something in between. The alpha channel is really a mask which specifies how the pixel's colours should be merged with another pixel when the two are overlaid, one on top of the other.

[0130] The equation used in alpha blending in a single layer display is:

$$[r,g,b]_{\text{blended pixel}}=\alpha[r,g,b]_{\text{foreground pixel}}+(1-\alpha)[r,g,b]_{\text{background pixel}}$$

where [r, g, b] are the red, green, blue colour channels and α is a weighting factor.

[0131] The weighting factor is allowed to take any value from 0 to 1. When α is set to 0, the foreground pixel is completely transparent; when it is set to 1, the foreground pixel becomes opaque and totally obscures the background pixel; any intermediate value creates a mixture of the two pixel's "images".

[0132] In a three layer multi-layer display system for example, a single display point on the front panel of the display unit actually has three separate pixels, arranged one in front of the other. Accordingly, conventional alpha blending techniques which produce resultant RGB values for a single pixel are inappropriate in a multi-layer display environment which requires RGB values for each of the overlaid